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MONTHLY NOTICES

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Professor Cayley, President, in the Chair.

S. J. Lambert, Esq. Auckland, New Zealand,

was balloted for and duly elected a Fellow of the Society.

The President announced, soon after the Meeting commenced, that the Astronomer Royal, at the suggestion of the Board of Visitors at Greenwich, had applied to Government for the means of organising parties of observers in the Southern Ocean, with the view of finding additional localities in the sub-Antarctic regions for observing the whole duration of the Transit of *Venus*.

The Rev. J. V. Mummery, at the same Meeting, presented to the Society a fine Photograph from a painting of the late Mrs. Somerville.

Notes on Star-Guaging.

By Richard A. Proctor, B.A. (Cambridge).

As several telescopists have expressed a wish to take part in the work of star-guàging, and to be informed as to the best way of making their work effective, I venture to give a few hints on the subject.

In the first place, it is to be noted that the main object of the proposed method of observation is to obtain complete general sur-

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veys of the heavens with various apertures. It is the direct result of the researches which I have already made, that mere random star-guaging will not suffice to give just views of the structure of the sidereal system; that, on the contrary, such a process is more likely to prove deceptive than useful. What is wanted is a survey which shall include the whole heavens (eventually), or at the beginning shall include the whole of each region surveyed, without gaps or interstices. But the extent of such a survey renders it absolutely necessary that it should be conducted in a manner the least elaborate that can be devised, so only that no essential details be neglected. To *map* the whole heavens with telescopes of considerable light-gathering power would require an army of observers where only a few volunteers are available; moreover, such mapping, while having a high value in other ways, would be less instructive regarded as star-guaging than a survey conducted by a few observers, each taking a considerable area. For the different powers of the observers engaged would cause noteworthy differences in the apparent numerical distribution of stars, and such apparent differences would be confounded with the real varieties of distribution which it is the object of the star-guaging to discover.

As respects the first point, completeness, I may remark that I have obtained very striking evidence on that subject. For the winter before last, with the $4\frac{7}{10}$-inch Sheepshanks belonging to the Society, I surveyed the region of the heavens included in the parts of *Taurus* north of 15° North Dec., using circular guage-fields, touching each other in R.A. Now, the results of the guaging thus conducted were so far interesting that they indicated in a very marked manner the prolongation (with increase of telescopic range) of that remarkable region poorly strewn with stars, which is shown in this part of the heavens in my chart of 324,000 stars. But on commencing the re-examination of this part of the heavens with the same telescope and eye-piece, but a field reduced to the figure of a square, I found a marked difference in the result as respects many details, though the general distribution was not very different.*

As respects the method to be employed, I think the following notes may be useful:—

A square field is the most convenient, and the side of the square may conveniently correspond to 15′ of a great circle. But this is not important—the field need not have any special size. An edge of the square should of course lie on a parallel of declination. The guaging eye-piece should be of rather low power, but not too low, especially with large instruments. The most suitable power will be indicated by what I have said as to the size of the field, if the diaphragm used to reduce the field be such as to give

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* I had proposed to resume the survey with the same telescope (using square fields) this year. But having had one of Mr. Browning's $12\frac{1}{4}$-inch reflectors placed at my disposal by Lord Lindsay, I naturally prefer to devote my time to a deeper survey.

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a square not much less than the inscribed square within the original circular field. On this point, however, little need be said, as in fact each observer can consider his own convenience, and so long as the nature of the eye-piece and size of field are indicated in the guage-book (together, of course, with the aperture of telescope, &c.), no difficulty will arise.

The most important point is the way of taking and recording guages. The work must be done in the dark, except when a new sweep is to be commenced. Therefore the observer should provide a number of squares of paper (or preferably card) to be strung on a cord, and mark in, in pencil, the number of stars counted in each field, passing each paper when thus marked from the set of unused papers to those already marked.

When a sweep begins the telescope (clamped of course in declination) is directed to the western extremity of the proposed sweep. The number of stars in the field is counted rapidly, and the telescope is moved eastwards until the western edge of the new field corresponds (as nearly as can be judged by estimation) with what had been the eastern edge of the former field. The process is repeated, field after field, until the proposed range of sweep has been completed (so nearly as can be judged). Thus, say the width of each field is 20′ in R.A., and that the observer desires to range 15° in R.A., he would count in this way 45 fields (or say two or three more to ensure the completion of the desired range). He must now determine the exact distance he has swept over, either in the regular way, when he has a suitable clock, or by noting the apparent difference of R.A., as indicated by the R.A. circle adding so much as corresponds to the time occupied in sweeping. The necessity for this process is obvious, when it is remembered that the shift from field to field has been made by estimation only, and *can* only be so made, except by methods which would involve delay and inconvenience. Thus the fields may slightly overlap, or there may be slight gaps (though no star can escape being counted), and the real range in R.A. may be several minutes less or greater than would be judged from the number of fields. But knowing the exact range of the sweep, and in the guage maps (afterwards to be constructed) dividing that range into so many equal parts as there were fields, no error of the least importance can accrue. The numbered papers should then be removed, with a portion of the string, this being tied round them, so that these papers may remain unchanged in order. The telescope must then be returned to its former position in R.A., that is the first field brought again into view, in doing which the range of R.A. can again be noted, if any doubt be felt as to the former determination. Then the telescope must be shifted in declination until a field north or south of the first is in view. This will, of course, be done in the usual way, by means of the declination-circle, since the exact size of the field is known. Another sweep will then be taken in the same way as the former. And the process may be repeated as

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long as the observer cares to remain at work. Care must, of course, be taken to keep the successive strings of guage papers distinct. This is readily effected by simply marking the first paper on each string with the declination of the central line of the sweep.

Note on the Possible Existence of a Lunar Atmosphere.

By E. Neison, Esq.

Owing to the many difficulties with regard to the constitution of the lunar surface involved in an assumption as to the absolute non-existence of a lunar atmosphere, it would appear of far greater probability that some such atmosphere, however limited, exists. Not only, as Dr. De La Rue has remarked, is it difficult to conceive any chemical formation of matter without an atmosphere; but it is also difficult to even find matter, exhibiting the features and properties of that constituting the lunar surface, which under the known conditions would not either yield an atmosphere, or require for formation the presence of substances that would.

The absolute absence of any atmosphere has never yet been demonstrated, but only the fact that it does not exceed certain limits, generally supposed much more restricted than is actually the case. In consequence, it is usually granted that some atmosphere might exist; it is also assumed that it must be of most extreme tenuity; and the subject is dismissed as a matter of indifference without inquiring where the admission might carry us in so far as relates to this atmosphere's power of fulfilling the same purposes as our own terrestrial one.

But it would be of interest to ascertain how far this possible lunar atmosphere might not effect for the lunar surface those changes, &c., that our own does for the terrestrial surface; and whether, in fact, it might not amply suffice for maintenance of, at least, some form of vegetable life. For the present, however, this must be deferred.

The only point restricting the extent of a lunar atmosphere of the nature supposed, appears to be its refractive power, more especially as shown by the occultation of stars by the Moon. Irrespective of the circumstance that these do not invariably answer conclusively in the negative, it does not appear to be generally recognised, that we may have an atmosphere whose maximum power of refraction would not be equal to one second of arc, and yet be of very considerable amount. For of however great tenuity, in comparison with our dense terrestrial atmosphere, it would be in reality present in large quantity; to be estimated, in fact, with regard to each square mile of surface, by very many thousands of tons.

There can be but little doubt but that such an atmosphere